Modular Robotics for Future Factories			
Credits: 4 Semester: 3 **Compulsory:** No			
Format	Lectures: 30 h	Examples: 18 h	Private study: 102 h

Lectures: G. Cannata, (G. Casalino)

Objectives:

It is currently widely recognized that a future much larger diffusion of robots for manufacturing will be achieved once the robotic research and development activities will have fully addressed the needs of SME manufacturers; which can be roughly summarized as follows

- Cost effectiveness at low lot sizes
- Intuitive to be used
- Easily adaptable to a wide variety of application tasks
- Easily reconfigurable kinematic structure, whenever needed

With the last three of the above points to be moreover operated by non-specialized personnel.

In this perspective it is also recognized that a substantial answer to the mentioned needs should relay on the development of modularly configurable robotic structures, which should also exhibit motion self-organizing properties ,once assembled.in the desired configuration.

Still in the mentioned perspective, the present course is therefore intended for providing the students with the fundamental mechatronic concepts and related technologies enabling the the realization of reconfigurable modular robotic structures; as well as the internally distributed (within the automatically connected computational units resulting from the assembly) self-organizing control methods and related algorithms.

Contents:

- Mechanical modular technology (joints-links

- Embedded/modular actuation technology

- Embedded/modular proprioceptive sensing technology (position, velocity, joint torque sensors)

- Modular exteroceptive technologies (force/torque/tactile concentrated and distributed sensing)

- Embedded/modular processing units

- Embedded internal networking

- local joint control algorithmic units units

- Distributed self-organizing control algorithms and related distributed computational structures.

- Distributed internal diagnostic and fault tolerance

- Self-configuring and self-assembly structures

- Foreseeable future factory application examples

- Extension to foreseeable future space applications

Abilities:

After completing this course, the students will gain the following capabilities.

    Establish the internal modular mechatronic organization of a modular units

    Establish the reconfigurable internal networking organization within modular structures

    Design, simulate and possible implement internally distribute self-organizing control algorithms

Assessment:

Continuous assessment (30%); final exam (70%).

Recommended texts:

Notes from the teachers

Scientific papers from recent literature

W. Bolton. Mechatronics: A Multidisciplinary Approach. Prentice Hall, 2009.